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PROBLEM SOLVING ABILITY AND SCIENCE PROCESS SKILLS AS THE INFLUENTIAL FACTORS OF SCIENTIFIC CREATIVITY

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ABSTRACT

The aim of the present investigation was to study the relationship of problem solving ability, science process skills and their interaction on scientific creativity of secondary school students. Survey method was used. The sample comprised of 158 students of Classes IX and X (mean age 14.8 years) studying in schools affiliated to Central Board of Secondary Education in SBS Nagar district of Punjab. Standardized tools used to access the variables were Problem Solving Ability Test by L.N. Dubey, Science Process Skills Test by (TSP-MK) Karuna Shankar Misra and Majumdar Scientific Creativity Test by S.K. Majumdar (1982). The data was analyzed using ANOVA. Scientific creativity was found to be significantly related with problem solving ability and science process skills. However no interactional influence of problem solving ability and science process skills was found on scientific creativity.

Keywords: Scientific creativity, Problem solving ability and Secondary school students.

INTRODUCTION:

"Wisdom first begins with wonder and it starts young" Socrates

Creativity is regarded as one of the cornerstones for economic and social progress in every society. There are two possible ways to get creative people to work for an enterprise or community. The first is by attracting creative employees by good working conditions – a solution for those who can afford such an approach. For communities that are not so rich, the only solution is to foster creativity by education.

Scientific progress depends on both conceptual and technological advances, which in turn depends on the creativity of scientists—their ability to produce new insights or ideas. Creativity is generally considered to be something to encourage in young children. It is, however, popularly associated more with the arts than with the sciences. As conceptions may be shaped by creativity

in the arts, it is suggested that science educators might loosen the connection by introducing students to the broader term of 'productive thought' that is, a combination of creativity and critical thought which is particularly relevant in science. Scientific creativity is the ability to find and solve new problems and the ability to formulate hypotheses; it usually involves some addition to our prior knowledge, whereas artistic creativity may give some new representation of life or feelings (Liang, 2002).

Results of earlier studies undertaken by Rajnish (1998) and Dubey (1994) confirm that significant correlation exists between problem solving ability and scientific creativity. Problem solving ability is a pathway to creativity. Problem solving performances requires much more than a simple coming back of facts or the use of well-defined procedure. It involves serious mental work, higher cognitive processes and systematic procedure for removal of difficulties and obstacles.

Various steps of scientific creativity are essentially also that of a creative process (Aktamis & Ergin, 2008). Science process skills have been grouped into basic and integrated skills. Basic skills include observation, classification, communication, measurement, estimation, prediction, inference and integrated skills include identifying and controlling variables, hypothesizing, experimenting, drawing graphs, interpreting, modeling.

One of the most important and pervasive goals of schooling is to teach students to think. All school subjects should share in accomplishing this overall goal.Various steps of scientific creativity are essentially also that of a creative process (Aktamis & Ergin, 2008). Kwatra (2000) generalized that there was significant correlation between science process and problem solving ability.

Science requires careful observation, logical intelligence, analytical thinking, vivid imagination and empiricism. The present investigation was undertaken to examine scientific creativity in relation to problem solving ability and science process skills of class IX and X students.

OBJECTIVES:

1. To study the influence of problem solving ability on scientific creativity of secondary school students.
2. To study the influence of science process skills on scientific creativity of secondary school students.
3. To study the interactional influence of problem solving ability and science process skills on scientific creativity of secondary school students.

HYPOTHESIS:

1. There is no significant influence of problem solving ability on scientific creativity of secondary school students.
2. There is no significant influence of science process skills on scientific creativity of secondary school students.
3. There is no significant interactional influence of problem solving ability and science process skills on scientific creativity of secondary school students.

METHOD:

For the selection of the sample, the cluster random sampling technique was used. The population, from which the sample of schools was selected, was schools affiliated to Central Board of Secondary Education, in district of SBS Nagar. The sample comprised 158 class IX sand X class students (mean age- 14.8 Years), out of which, 62 were males and 96 were females.

MEASURES:

1. Majumdar Scientific Creativity Test by S.K. Majumdar. (1982).
2. Problem Solving Test (PSAT-D) by L.N. Dubey.
3. Science Process Skills Test by (TSP-MK) Karuna Shankar Misra.

DESIGN:

The objective was to study the influence of Problem Solving Ability, Science Process Skills and their interaction on scientific creativity of secondary school students. There were three levels of Problem Solving Ability, namely, high, intermediate and low. There were three levels of Science Process Skills, namely high, intermediate and low. The data related to this objective were analyzed with the help of 3x3 analysis of variance.

INTERPRETATION:

Table : 1

Summary for 3×3 Factorial Design for influence of Problem Solving Ability, Science Process Skills and their Interaction on Scientific Creativity of Secondary School Students

Source of Variance	Sum of Squares	Df	Mean Squares	F-Value
Problem Solving Ability (A)	7050.12	2	3525.06	4.69*
Science Process Skills (B)	14811.15	2	7405.57	9.86**
A×B	3820.49	4	955.124	1.27
Error	111927.25	149	751.19	
Corrected Total	170259.27			

*Significant at 0.05 level

** Significant at 0.01 level

From Table 1, it can be said that F-Value Problem Solving Ability was 4.69, which is significant at 0.05 levels. It indicates that mean scores of Scientific Creativity of secondary school students belonging to three levels of Problem Solving Ability differ significantly. In this context, the null

hypothesis, There is no significant influence of Problem Solving Ability on Scientific Creativity of secondary school students is rejected. It may, therefore be concluded that Scientific Creativity of secondary school students was found not to be independent of Problem Solving Ability

The F-Value for Science Process Skills is 9.86, which is significant at 0.01 levels. It indicates that the mean scores of Scientific Creativity of secondary school students belonging to three levels of Science Process Skills differ significantly. In this context, the null hypothesis, There is no significant influence of Science Process Skills on Scientific Creativity of secondary school students is rejected. It may, therefore be concluded that Scientific Creativity of secondary school students was not found to be independent of Science Process Skills.

The F-Value for interaction between Problem Solving Ability and Science Process Skills is 1.27, which is not significant at 0.05 levels. It indicates that there is no significant influence of interaction between Problem Solving Ability and Science Process Skills on Scientific Creativity of Secondary School Students. In this context, the null hypothesis, There is no significant influence of Interaction between Problem Solving Ability and Science Process Skills on Scientific Creativity of secondary school students is not rejected. It may, therefore be concluded that Scientific Creativity of secondary school students was found to be independent of the interaction between Problem Solving Ability and Science Process Skills.

DISCUSSION:

It can be inferred that both problem solving ability and science process skills have significant influence on scientific creativity of secondary school students. These results are cognizant with earlier studies undertaken by Rajnish (1998) and Dubey (1994) that confirm that significant correlation exists between problem solving ability and scientific creativity. Significant relationship between Scientific Creativity and Science Process Skills established by Lee and Lee (2002), Aktamiş and Ergin (2008) and Mirzaie, Hamidi and Anaraki (2009) are in sync with present findings.

Previous studies on creativity have proved that creativity is closely correlated with problem solving abilities, divergent thinking, cognitive style, cognitive skills, creative attitude and critical thinking. There exist both differences and similarities in the process of artistic and scientific creativity. It has been verified that science activities have a positive bearing on creativity. The focus of creativity studies has zeroed down upon scientific creativity in recent past. Scientific creativity tests have been instrumental in evaluating scientific creativity.

The field of creativity has undergone an immense evolution with surfacing of experimental and co-relational research dealing with the efforts to promote creative thinking in schools and colleges and institutes of higher learning. Although, creativity has been studied by the psychologists and researchers for many years, studies in scientific creativity are rare (Mansfield and Buse, 1981; stated in Liang, 2002).

In western and developed societies, there are organizations and societies specifically devoted to this purpose, such as American Creativity Association, The Center for Creative Learning, The Center for Applied Research in Creativity etc. Of all the environmental influences of development of creativity, education has received special interest. It is the business of education to determine to what extent creativity can be improved and how this shall be accomplished. But absence of such machinery in a developing country like ours makes it imperative to emphasize the role and goal of scientific creativity in academic arena. Creative potential of students in science classrooms is seldom tapped and promoted. Therefore spending time and energy focusing on problem solving strategies and promoting science process skills while working on scientific creativity is a worthwhile pursuit.

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